

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,880,386 B1
DATED : April 19, 2005
INVENTOR(S) : Hans-Ulrich Krottil et al.

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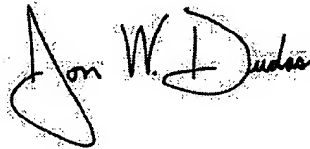
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page should be deleted and substitute therefor the attached title page.

Replace sheets 1 through 12, showing Figs. 1 through 13D, with attached sheets 1 through 12 showing Figs. 1 through 13D.

Signed and Sealed this

Thirteenth Day of September, 2005

A handwritten signature in black ink, appearing to read "Jon W. Dudas". The signature is stylized with a large, looped initial "J" and a cursive "Dudas".

JON W. DUDAS
Director of the United States Patent and Trademark Office

(12) **United States Patent**
Krottil et al.

(10) Patent No.: **US 6,880,386 B1**
(45) Date of Patent: **Apr. 19, 2005**

(54) **METHOD AND DEVICE FOR
SIMULTANEOUSLY DETERMINING THE
ADHESION, FRICTION, AND OTHER
MATERIAL PROPERTIES OF A SAMPLE
SURFACE**

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Thomas Stifter, Illereichen (DE);
Othmar Marti, Ulm (DE)**

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

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§ 371 (c)(1),

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PCT Pub. Date: **Jul. 13, 2000**

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(51) Int. Cl.⁷ **G01N 13/16; G01N 19/02;
G01N 19/04; G01B 11/30; G01B 21/30**

(52) U.S. Cl. **73/105**

(58) Field of Search **73/105, 9, 866,
73/801; 250/306-307**

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Primary Examiner—Thomas P. Noland

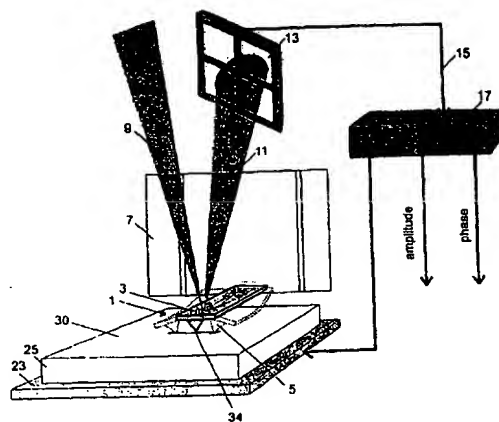
(74) Attorney, Agent, or Firm—Baker & Daniels

(57)

ABSTRACT

A process for the location-resolved simultaneous detection
of the adhesion and friction as well as possibly of other
material properties of a sample surface to be examined by
means of a raster probe microscope comprising a raster
probe. The raster probe and/or the sample with sample
surface are moved until at a point of the sample surface to
be examined the raster probe interacts in a determined
manner with this surface. The raster probe and/or the sample
are subjected to a vertical oscillation, and a first measuring
signal characterized by the deformation of the raster probe
is recorded. A second measuring signal characterizing the
deformation of the raster probe is recorded, wherein the
raster probe and/or the sample are subjected to a horizontal
and/or vertical oscillation. From these two measuring sig-
nals the desired material properties are determined. For the
detection of the entire surface area to be examined the raster
probe and or the sample are again moved and for the
repetition of the measuring process described brought into
contact with the sample surface in the above described
manner.

10 Claims. 12 Drawing Sheets

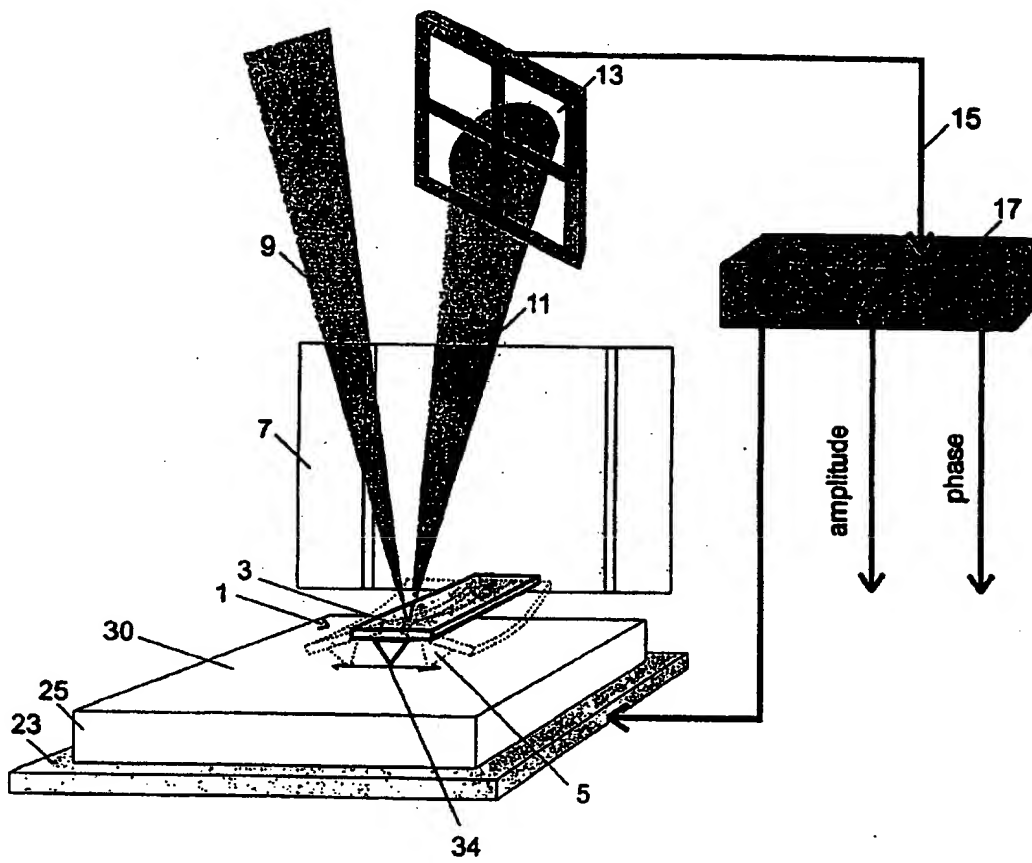


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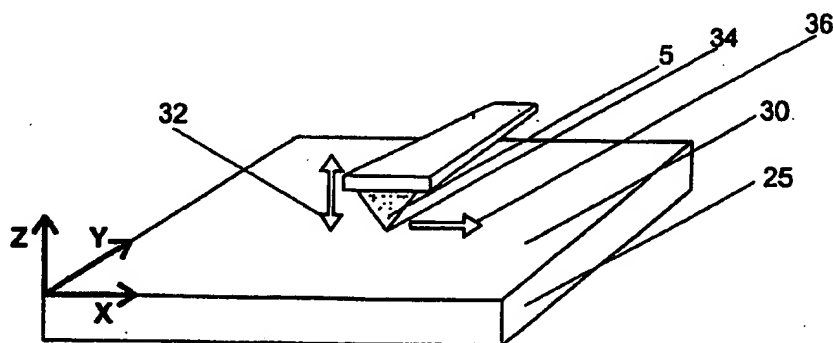


Fig. 2

NORMAL
PERPENDICULAR FORCE

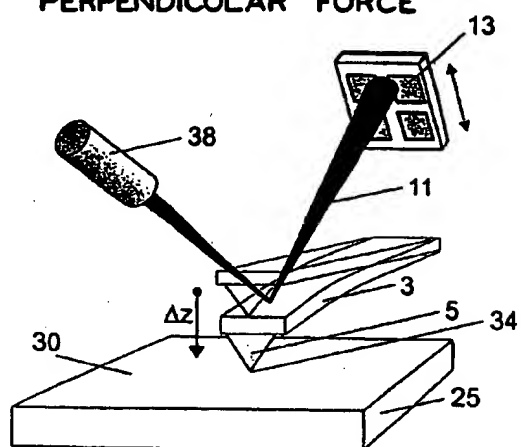


Fig. 3A

LATERAL FORCE

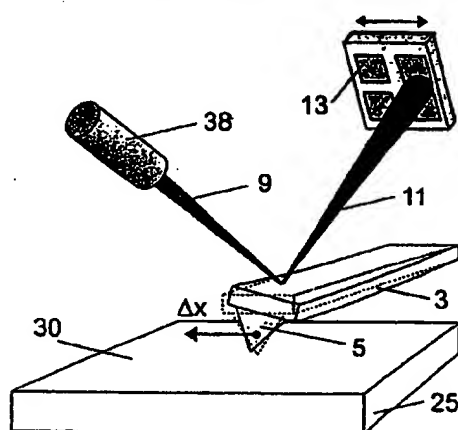
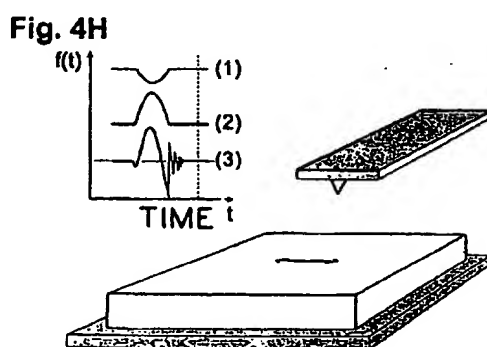
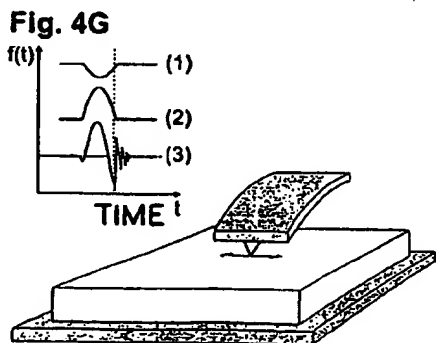
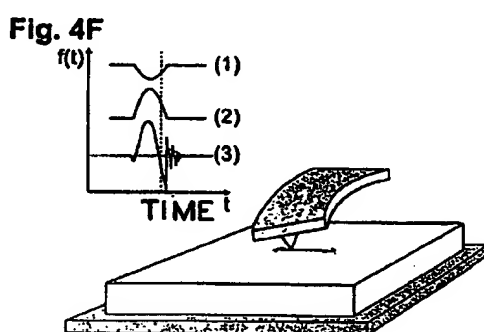
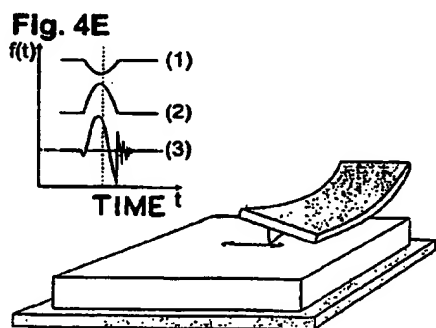
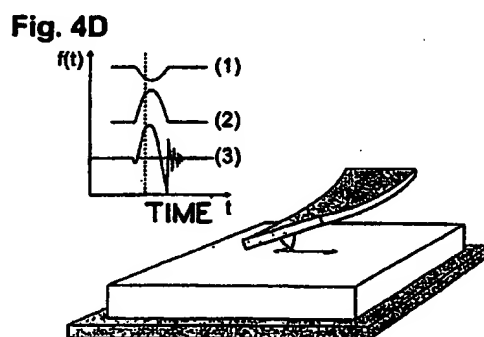
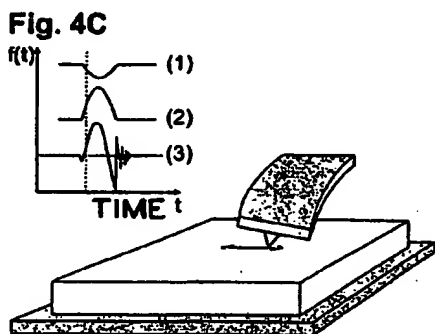
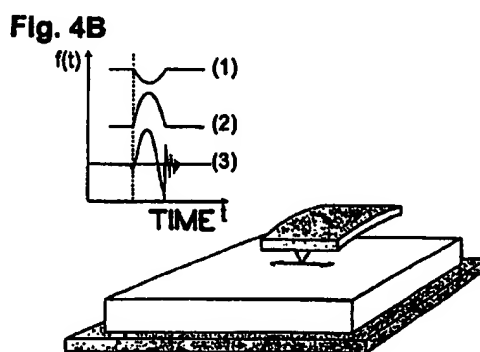
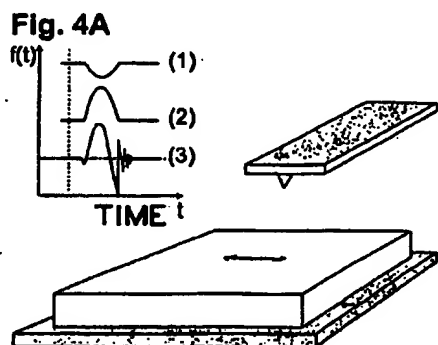


Fig. 3B



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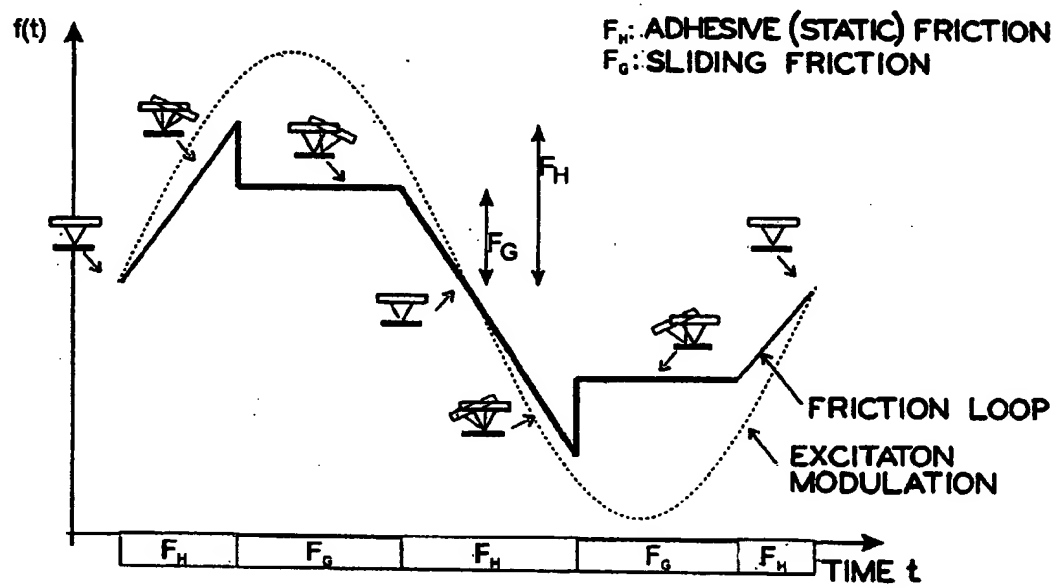


Fig. 5

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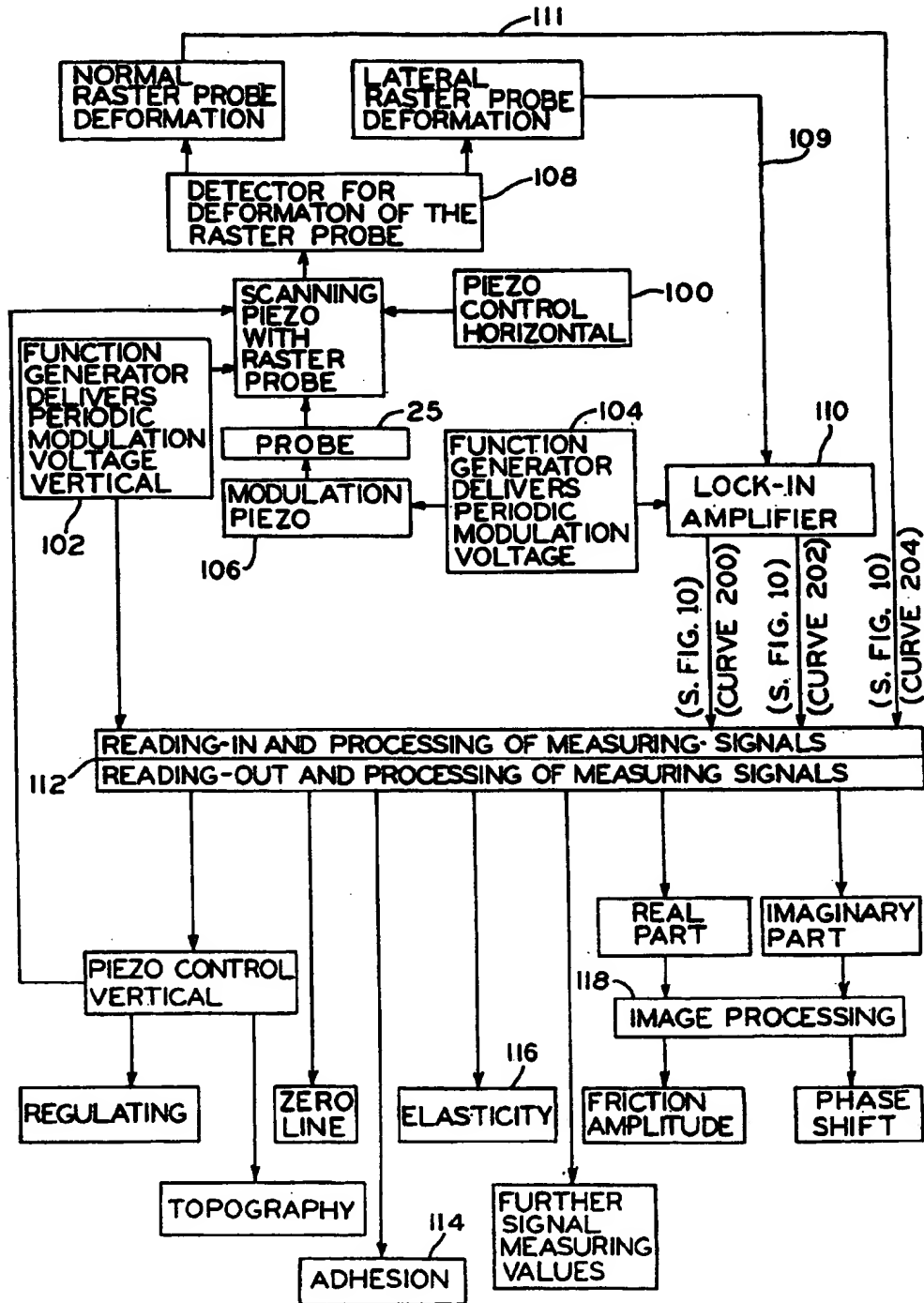


FIG. 6

Fig. 7A

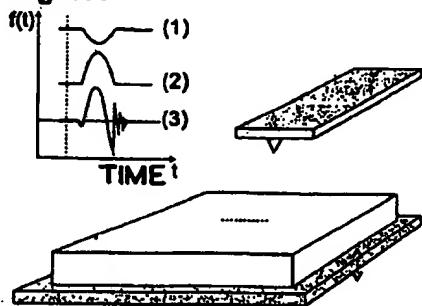


Fig. 7B

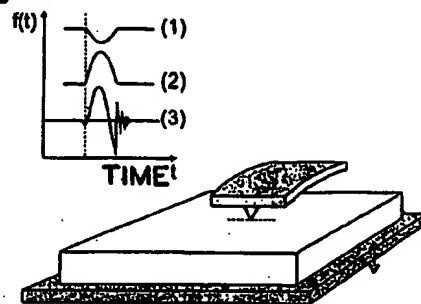


Fig. 7C

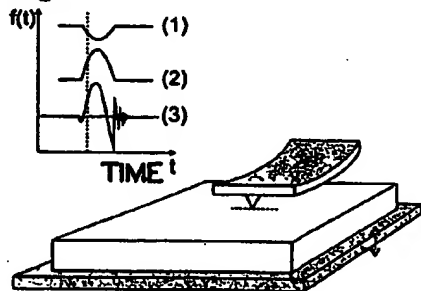


Fig. 7D

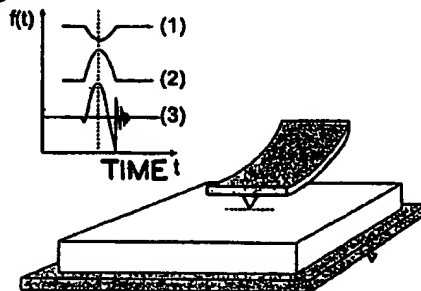


Fig. 7E

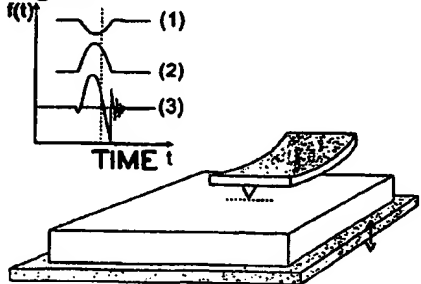


Fig. 7F

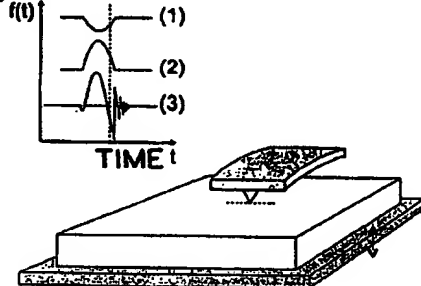


Fig. 7G

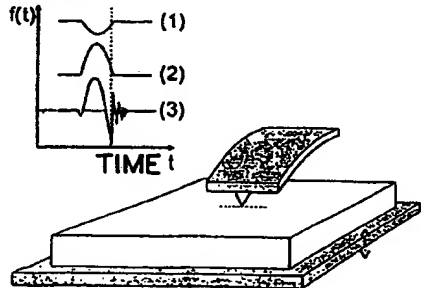
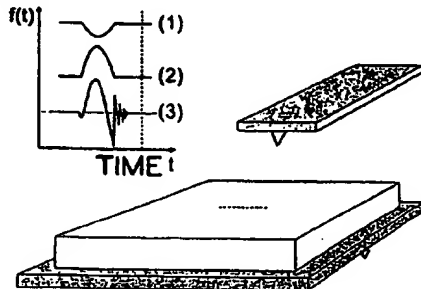


Fig. 7H



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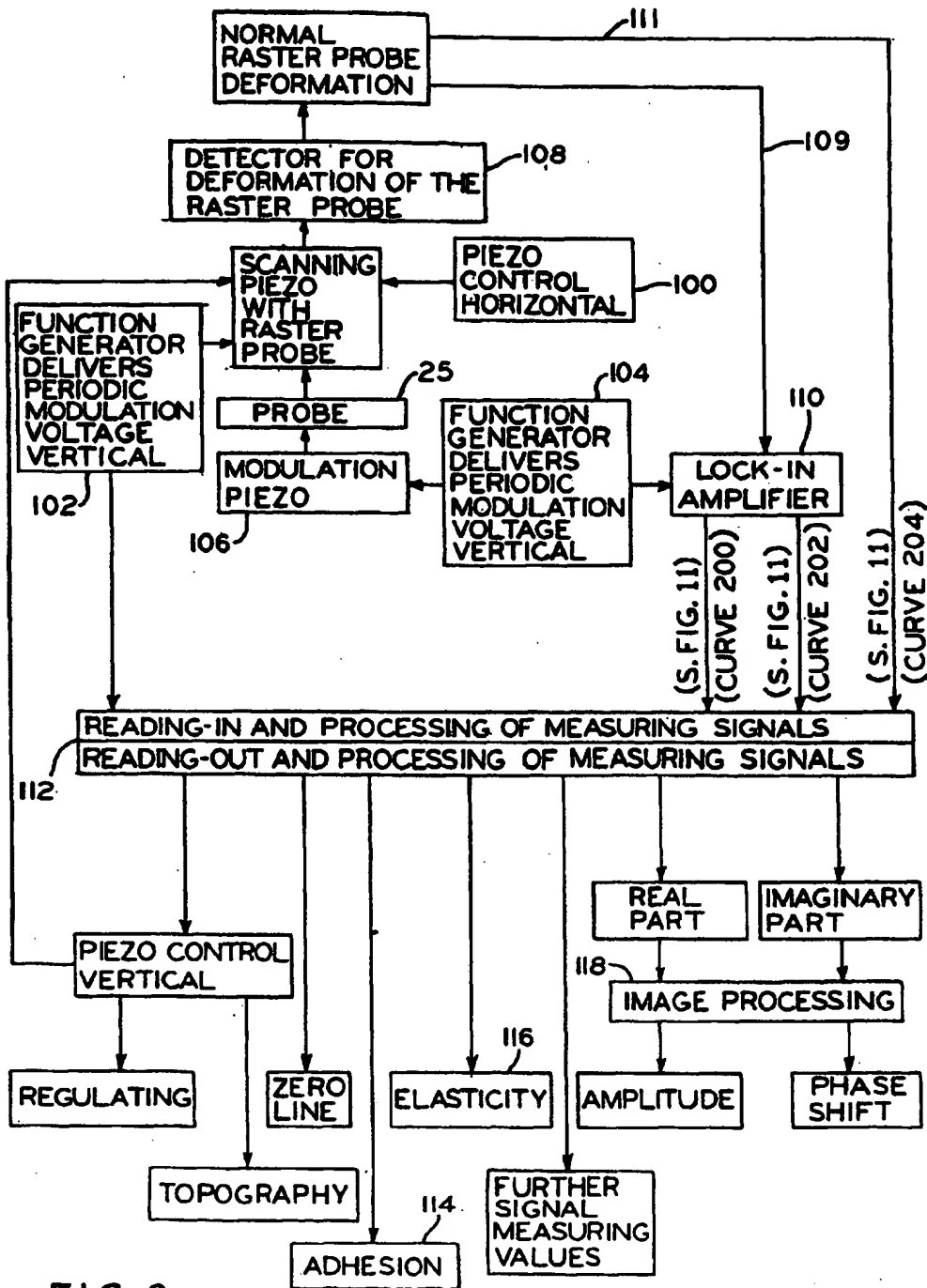


FIG. 8

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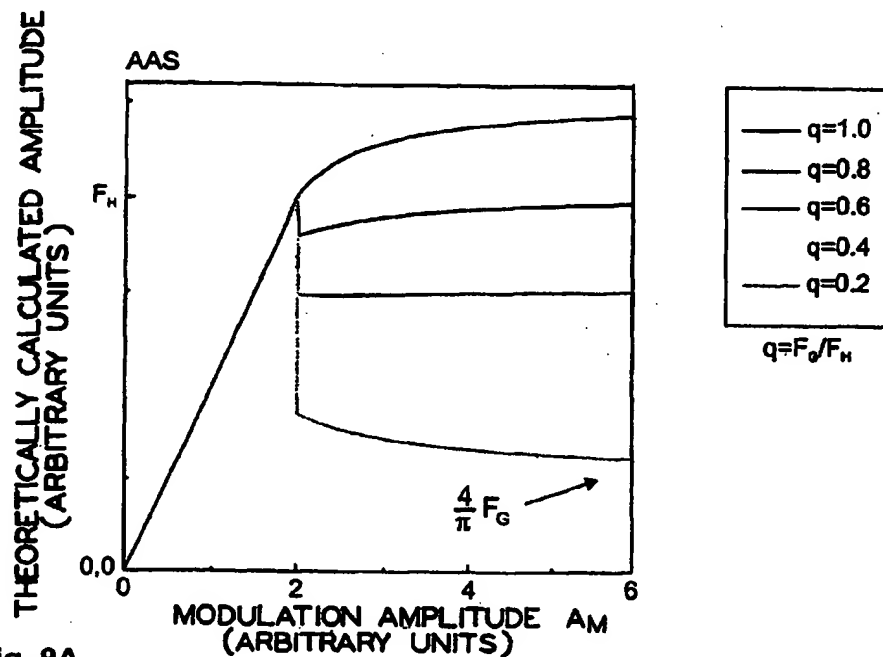


Fig. 9A

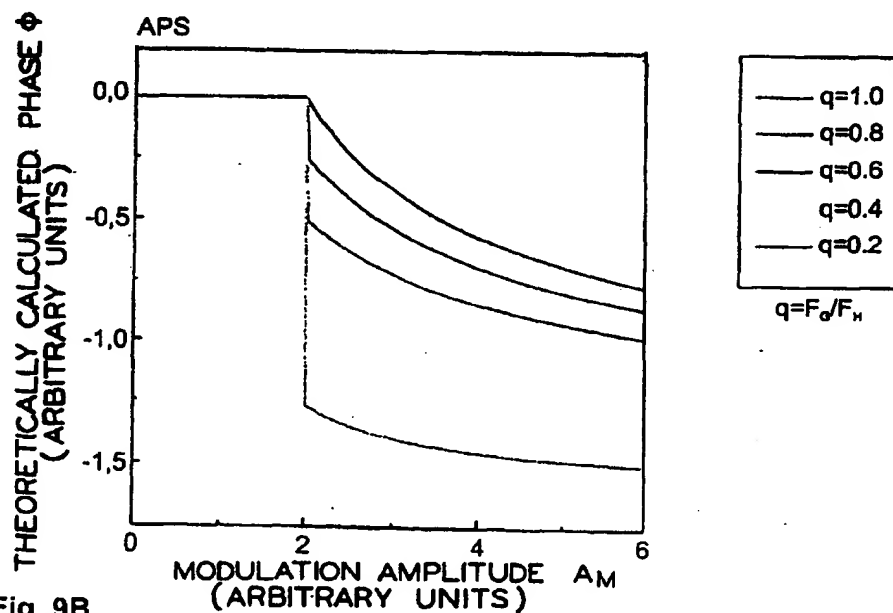


Fig. 9B

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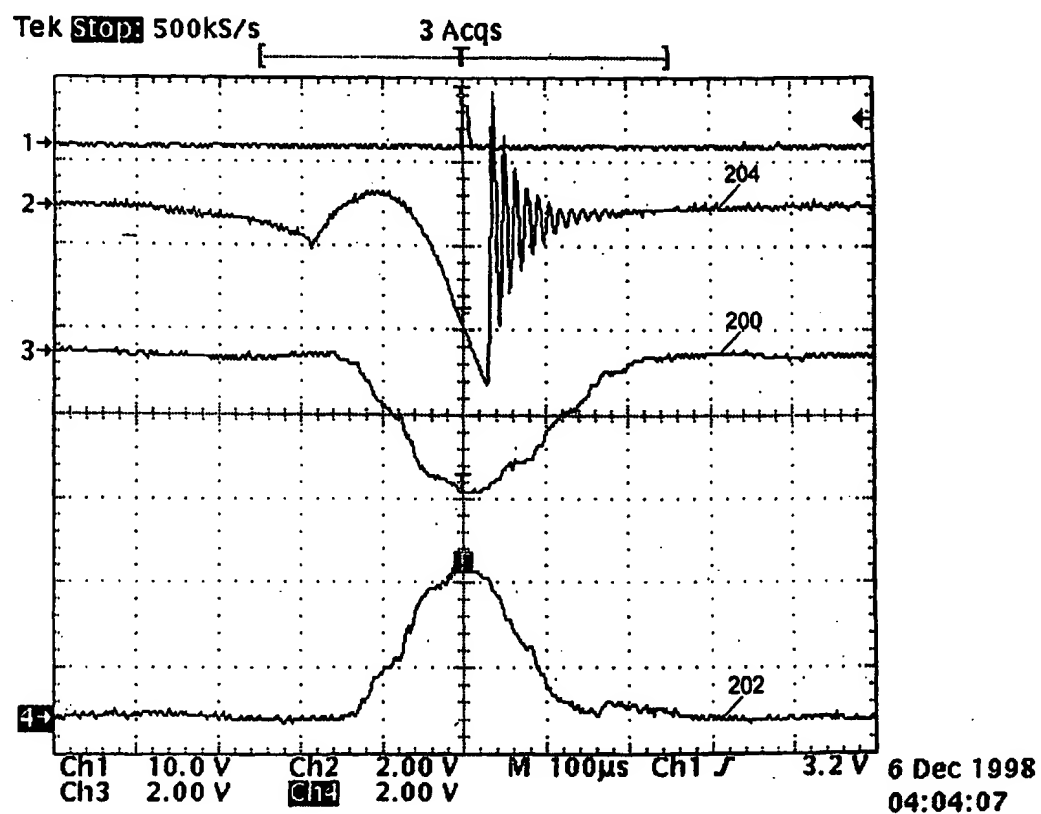


Fig. 10

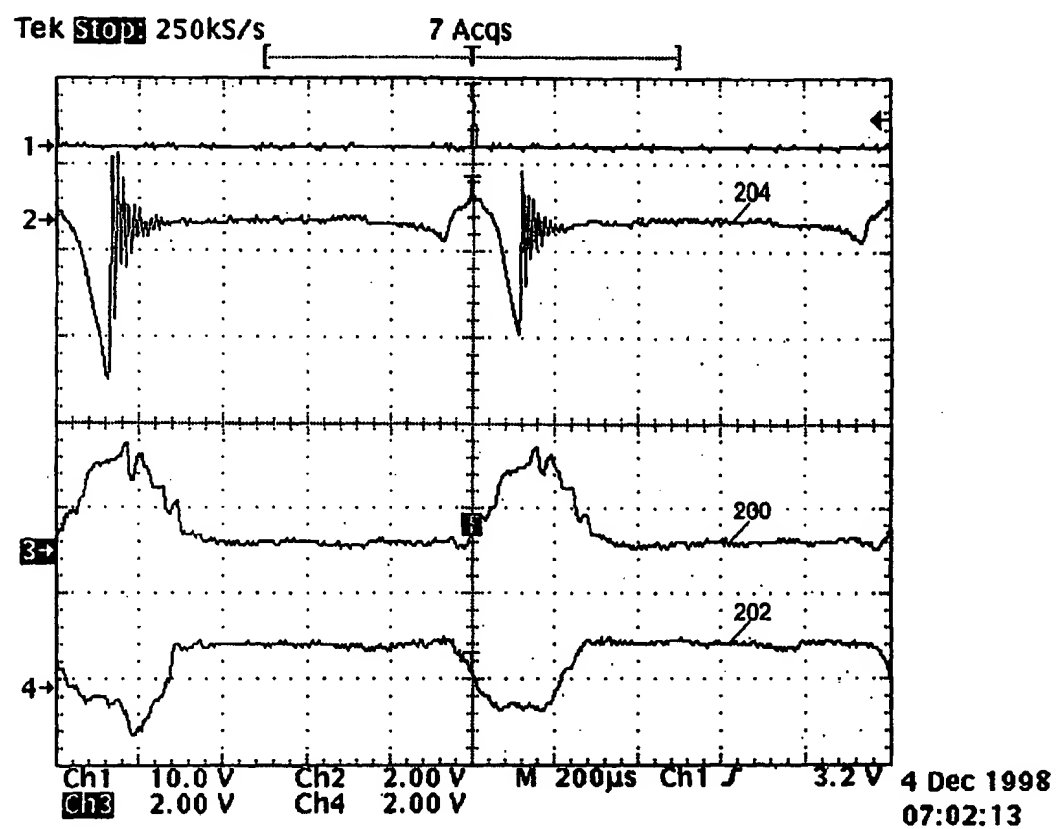


Fig. 11

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POLYMER SAMPLE,
IMAGE SIZE $25\mu\text{m}^2$,
93kHz / 1kHz



Fig. 12A

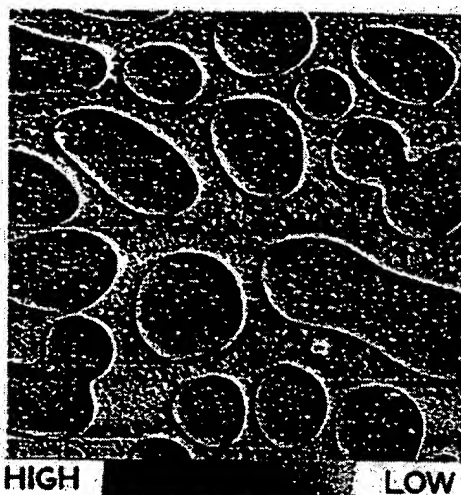


Fig. 12B

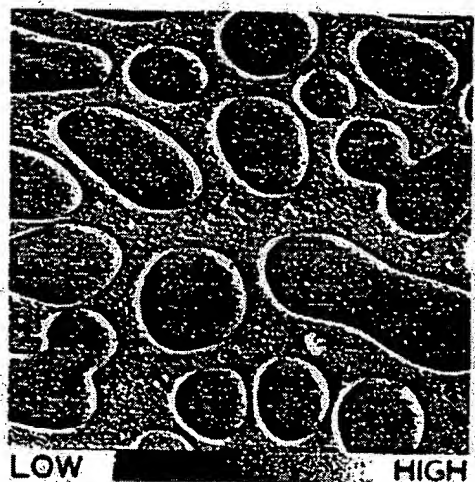


Fig. 12C

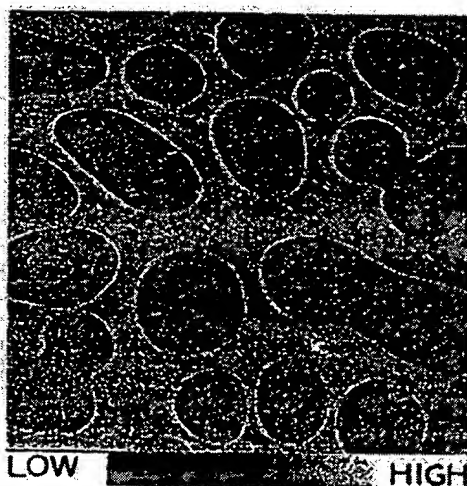


Fig. 12D

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POLYMER SAMPLE,
IMAGE SIZE 25 μm^2 ,
230kHz / 1kHz

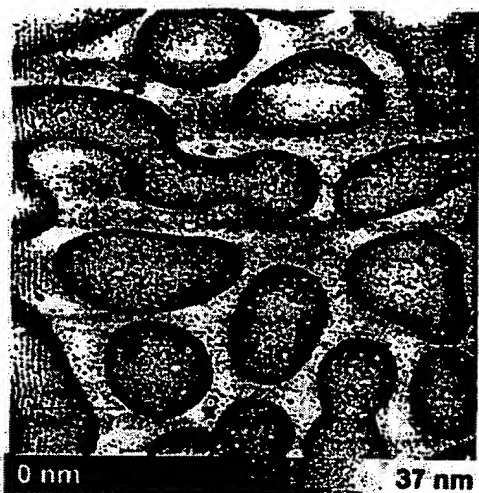


Fig.13A

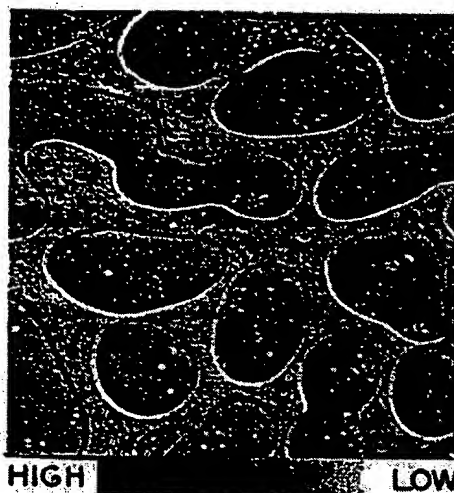


Fig.13B

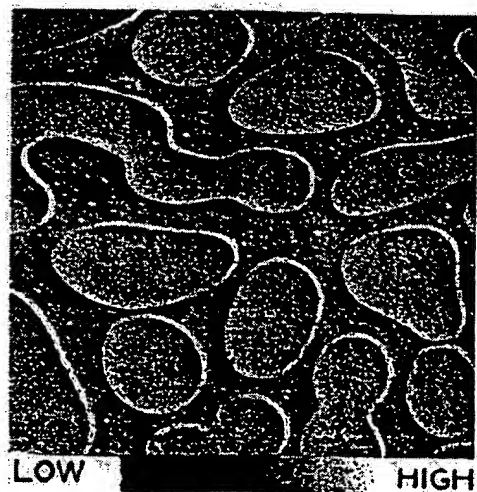


Fig.13C

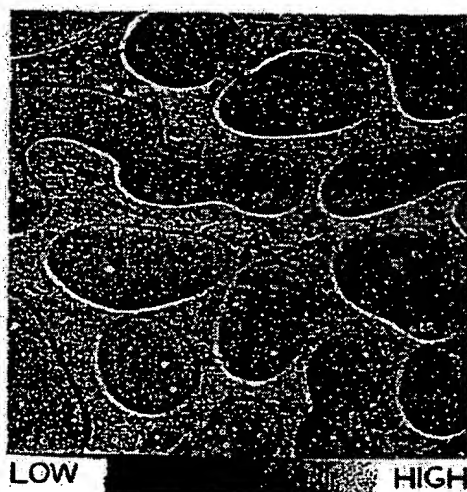


Fig.13D

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